SCIENTIFIC CASE:
Mission to the Moon[1]

Team members

Writer: _____

Equipment manager: _____

Reader: _____

Spokesperson: _____

Measurement and cutting: _____

Context

The Moon is Earth's only natural satellite. Look at the size of the Moon in comparison to our planet:

1 Designed by Planeta Ciencias, in collaboration with the CESAR team.

Relationship between the Earth and the Moon. Source: Wikipedia.org

In addition, the Moon revolves around the Earth, taking 27 days to complete a full orbit.

Distance between the Moon and the Earth. Source: Wikipedia.org

As you might imagine, going on a mission to the Moon is a whole adventure!

Resources:
Useful information about ESA missions to the Moon (English):

SMART-1: http://www.esa.int/Our_Activities/Space_Science/SMART-1

AURORA programme: http://www.esa.int/Our_Activities/Human_Spaceflight/Exploration/The_European_Space_Exploration_Programme_Aurora

Additional educational ESA resources for teachers:
http://www.esa.int/Education

CESAR project:
http://www.cosmos.esa.int/web/cesar

ESA Kids:
http://www.esa.int/esaKIDSes

Scientific case: Mission to the Moon

We are going to plan a mission to send three astronauts to the Moon; and there is a lot of preparation needed for it.

“Hovering on the Horizon” - NASA Earth Observatory. Source: Wikipedia.org

Preparation (part 1): What to take to the Moon

We really need to think what we are going to send. Just so you get a rough idea, we would need a force equivalent to twenty thousand slingshots (20,000 slingshots) to launch a single kilogram of weight out of Earth!

Preparation (part 2): Where to aim and when to launch

We have done some math and we know that the journey will take five days. If we aim towards where the Moon is now, will it still be there when the rocket gets to that point?

Preparation (part 3): Shape, size and design of the ship

What shape do you think the rocket would have to be in order to go through the atmosphere, travel through space and get our astronauts to the Moon? Additionally, if three people will make the trip, it is important that they feel okay during the journey.

Preparation (part 4): Where to land and why

Not every place on the Moon is the same, and it's very important to decide where to land.

Preparation (part 5): What to do on the Moon

A lot of questions come to mind when we look at the Moon. This is the moment to do our research in our neighboring world!

MISSION DEVELOPMENT

Preparation (part 1): What to take to the Moon

Research equipment for part 1:

- Pencils, paper, rubber.
- Scissors.
- Glue.
- Cut-outs
- Colour pencils

Step 1. The Moon and space.

The Moon and space are very distinct from our planet. In order to know what we need, we first have to think about what's important for life that doesn't exist out there.

Differences between Planet Earth, the Moon, and space.

e.g: There is no air on the Moon and in Space.

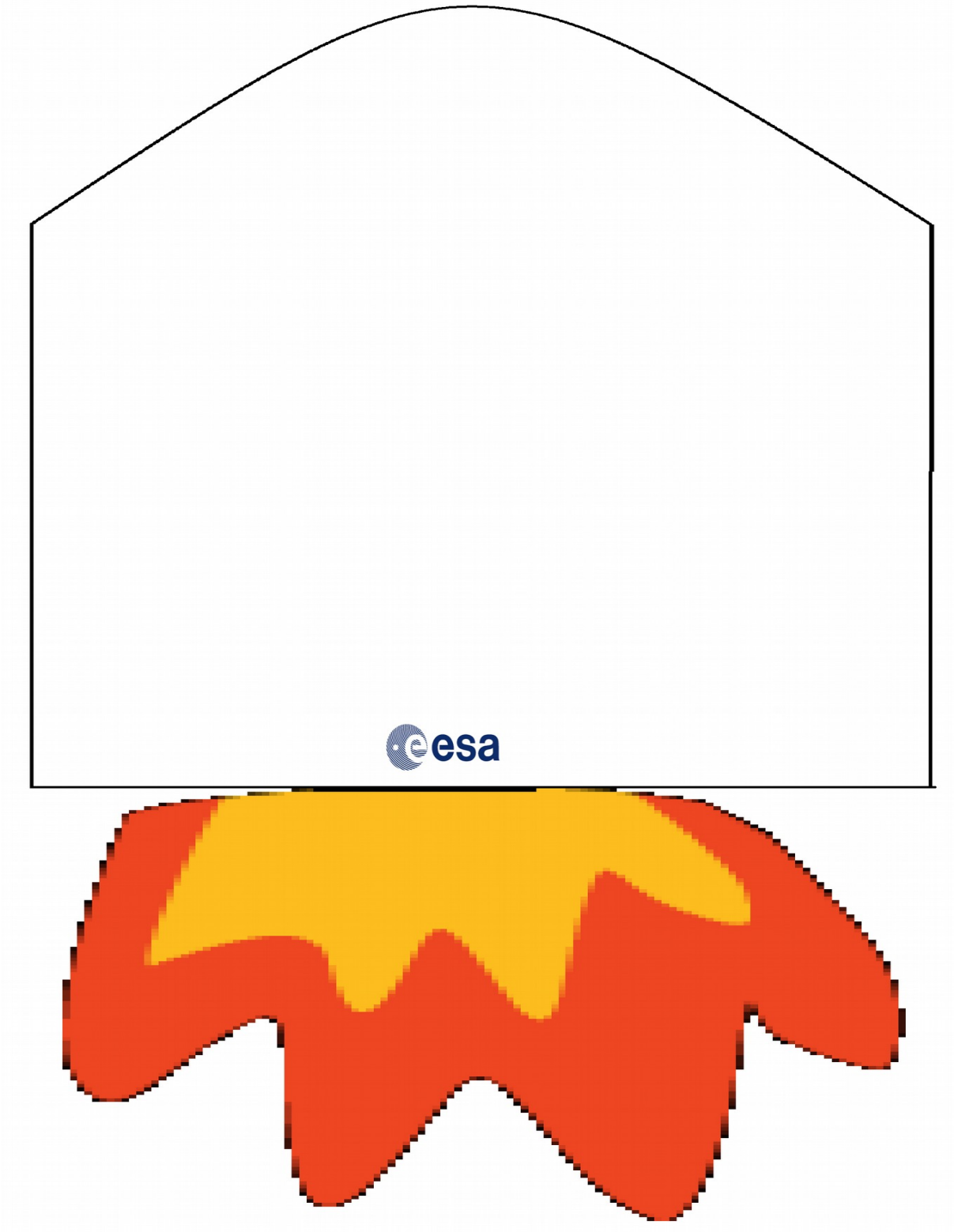
Step 2. What to take.

Imagine you are one of the astronauts. What objects, utensils, etc., would we take in our spaceship?

Write out a list of important things you would take on your trip. Then, draw a green circle around the items you think are indispensable.

*e.g: Space suit*_____	_____	
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Step 3. We have a baggage list! Now we just have to open the envelope and glue the cut-ots that are on your list. If there is a cut-out missing, you can draw it:


esa

Draw and cut out what you're missing

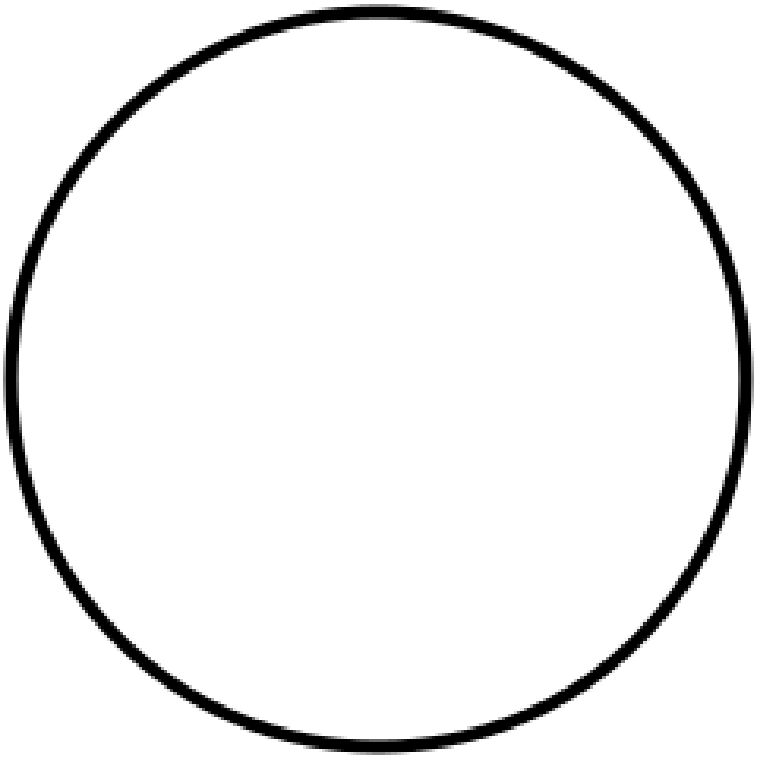
Preparation (part 2): Where to aim and when to launch

Equipment for Part 2 research

- Pencils, paper, rubber.
- Black pencil.

Some days we see the Moon as round and lit (full moon), other times it looks like a C (waxing), like a D (waning), or even invisible (new moon). Those are the **phases of the Moon**: from Earth we see parts of the Moon depending on how sunlight reaches it.

We need to think about whether we want it to be daytime, nighttime, or somewhere in between when we get to the Moon (that is, full moon, new moon, waxing or waning, respectively).



Having done the math, we know the journey will be 5 days long. So we have to take a look to the lunar calendar below to know which day we'll take off from Earth and which day we'll get to there, taking into account the Moon we just filled out.

Source: Wikipedia.org (modified from original file). Motion available at: https://upload.wikimedia.org/wikipedia/commons/b/ba/Lunar_libration_with_phase_Oct_2007_450px.gif

Take-off date form Earth: _____

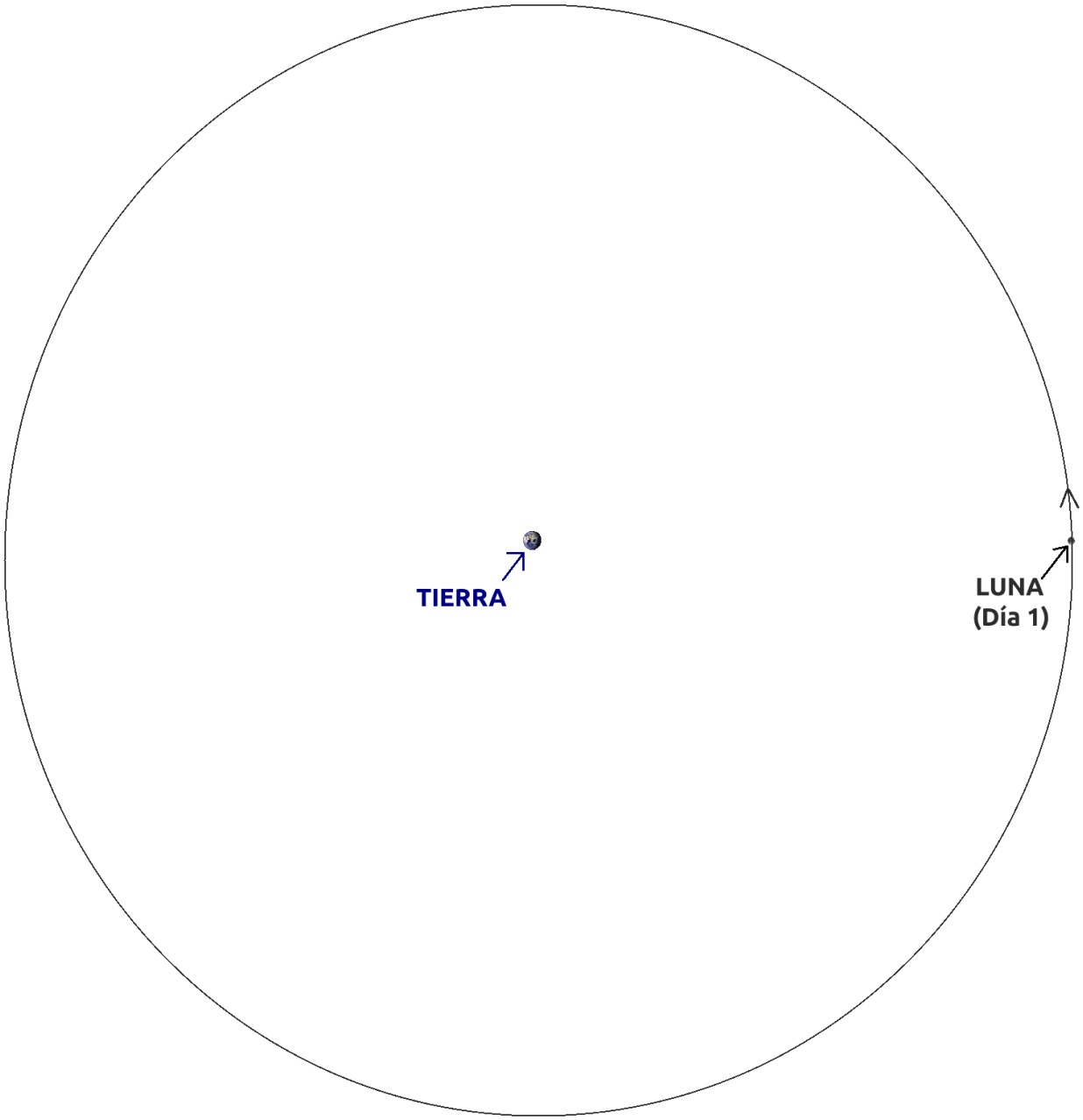
Moon landing date: _____

Now comes the hard part! Have you ever seen how the Moon moves? If we aim our rocket to where the Moon is rght now, do you think it will still be there after five days? Of course, it will have moved by then. So we have to aim our rocket to where the moon will be five days from now.

Let's try playing darts with a moving target. Ask your teacher how!

Have you played already? Take a look at the pixture below, where we can see the Moon's movement around Earth (remember a full orbit takes 27 days).

If the Moon is where the image says, let's draw:
1. The Moon where we think it will be five days form now.
2. Our rocket's path, from Earth to the Moon, with a line.



The Moon's path around Earth.

Preparation (part 3): Shape, size and design of the ship

Research equipment:

- Pencils, paper, rubber.
- Blank paper.
- Colour pencils.

Three astronauts will travel on our spaceship. It's important to draw the inside and the outside, so that it fulfills all our needs.

Step 1. The Moon and space.

The Moon and space are very distinct from our planet. In order to know what we need, we first have to think about what's important for life that doesn't exist out there.

Differences between Planet Earth, the Moon, and space.

e.g.: there is no air on the Moon or in space

Step 2. The outside of the rocket.

We are going to write what our spaceship must have on its outside so that it can get to the Moon and come back with its passengers safe and sound.

e.g.: solar panels to obtain energy	
_____	_____
_____	_____
_____	_____
_____	_____

Step 3. The insides of the rocket.

We are going to write what our spaceship must have on the inside in order for our voyagers to travel comfortably.

_____	_____
_____	_____
_____	_____
_____	_____

With all the ideas we have written, we are now ready to design our ship, on the outside and inside.

Step 4. Design of the outside of the rocket (before drawing here, you can make some rough drafts in other sheets of paper)

Step 5. Design of the inside of the rocket (before drawing here, you can make some rough drafts in other sheets of paper)

Preparation (part 4): Where to land and why

Research equipment for part 4

- **Map of the moon**
- Pencils, paper, rubber.
- Two markers of different colours

Not every place on the Moon is the same, and it's very important to decide where to land.

With that purpose, we are going to look at the map you'll be given, and draw an orange circle in three places that look very different to you. Then, we are going to write what we see in each of these sites, and what we think we could find there:

Site 1:

Site 2:

Site 3:

Now that you've taken a good look at these three sites, it's time to debate among yourselves and decide which one is best for landing. When you know, draw a green circle around the definitive one, and explain **why you have chosen that particular place to land.**

Preparation (part 5): What to do on the Moon

There are surely a lot of questions we ask ourselves when we look at the Moon. Imagine we have gotten there on our rocket, at last. How do you figure the Moon will be? What would you like to find there? What would you like to do there? Let's draw it!

_____ on the Moon

Twelve men walked the near side of the Moon between 1969 and 1972, and did scientific experiments on the surface.

In recent years, a lot of agencies have decided to go back to the moon, among which the European Space Agency. Orbiting satellites have explored the surface with great detail, one of the biggest discoveries has been the finding of frozen water in the bottom of craters near the Moon's poles. Hidden from sunlight, the ice could have been there for millions of years. Future explorers could take advantage of it for obtaining oxygen and drinkable water.

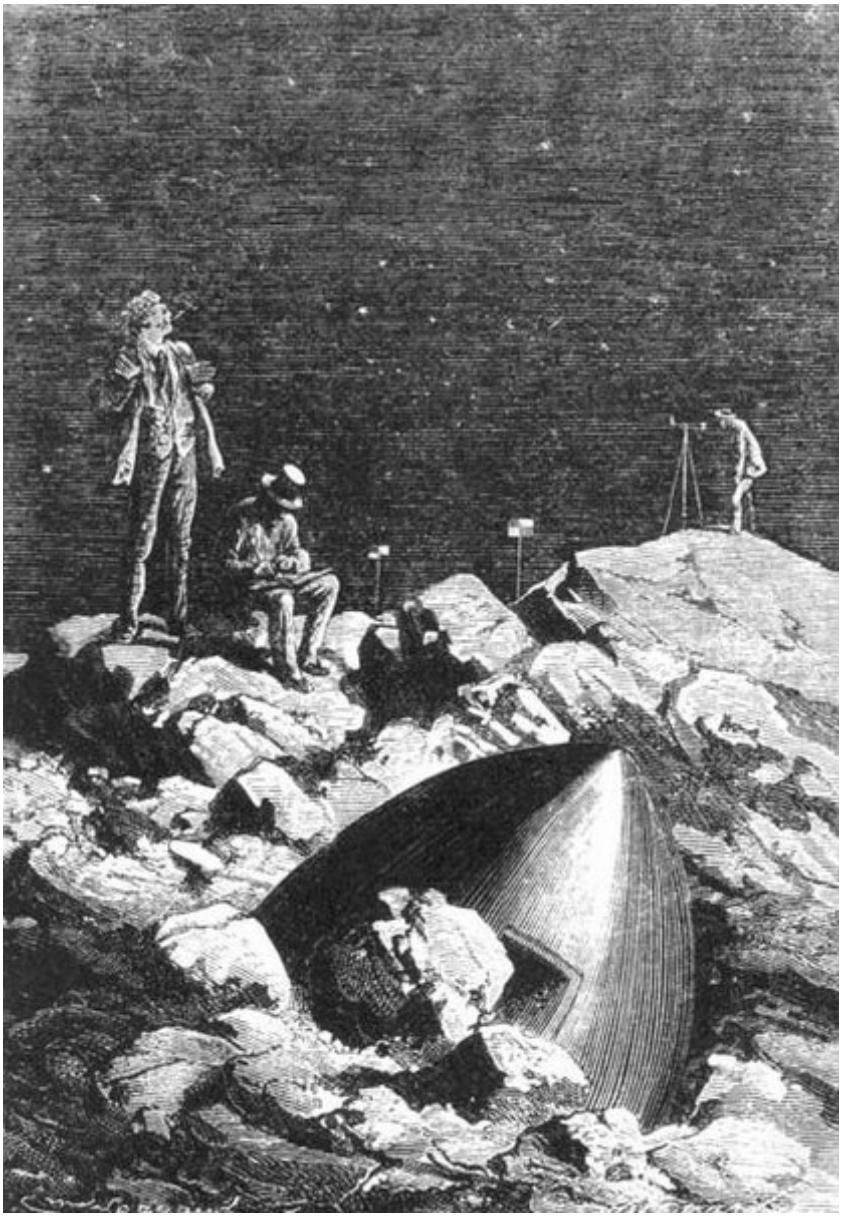


Illustration from novel "Around the Moon", by Jules Verne.

Book illustrations made by Émile Bayard and Alphonse-Marie-Adolphe de Neuville.

Source: http://jv.gilead.org.il/rpaul/Autour%20de%20la%20lune/